Google Marketing Platform

DV3 Brasília Update:
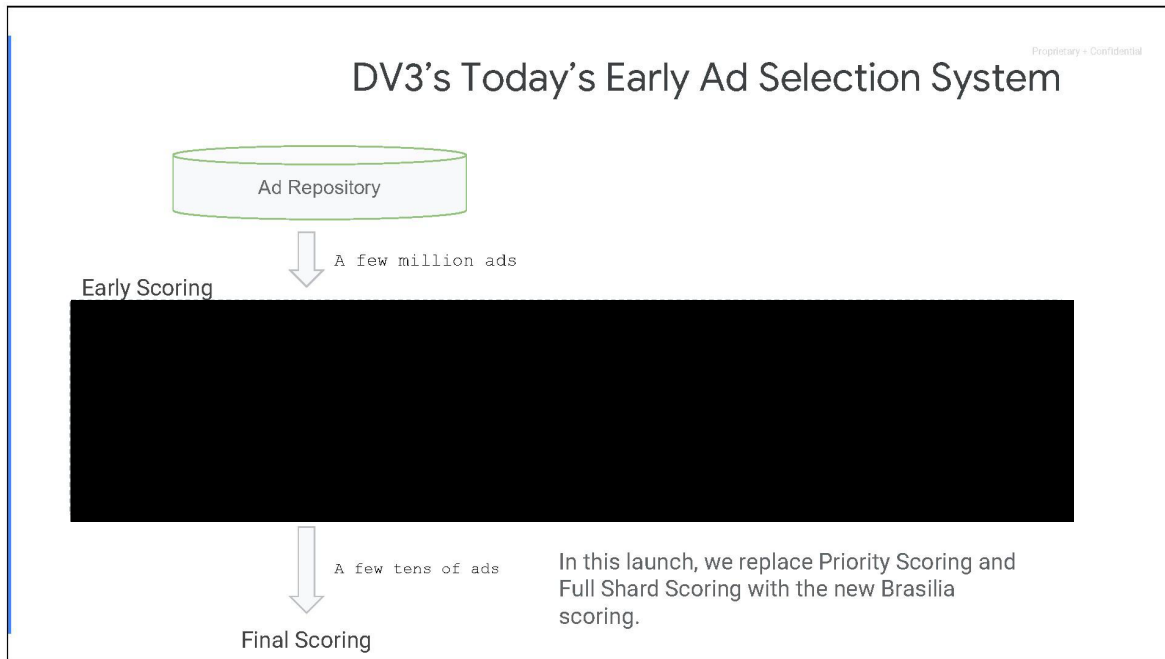## A Unified System for Large-Scale Optimal Ad Selection

Jun 25 2021
dbm-optimization & AViD Optimization Infra
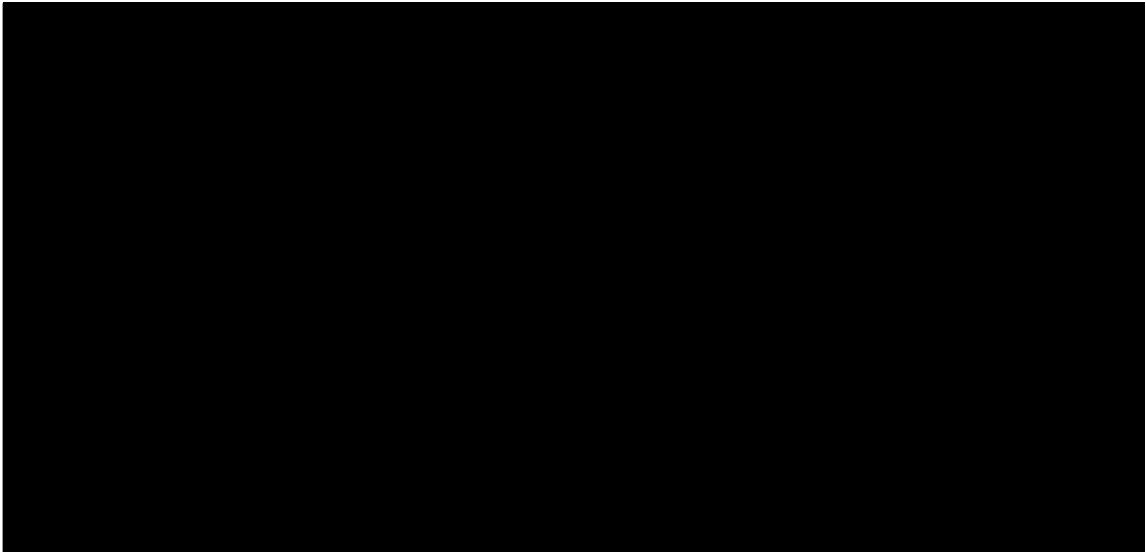
Summary

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- Project Brasília seeks to redesign and simplify the process of ad selection in serving to improve quality, efficiency, and hence to allow for better system scalability in the future
- This is the first launch in a series of launches that help us get to the full potential of the project. Follow up launches include:
  - Launches that allow us to fully implement the Brasília vision
    - Here we outline that vision and also point out changes that are specific to this launch
  - Add known improvements in the modeling
  - Improve the infrastructure to reduce resource requirements and allow for larger scale
- All 3 areas are currently work in progress in parallel efforts

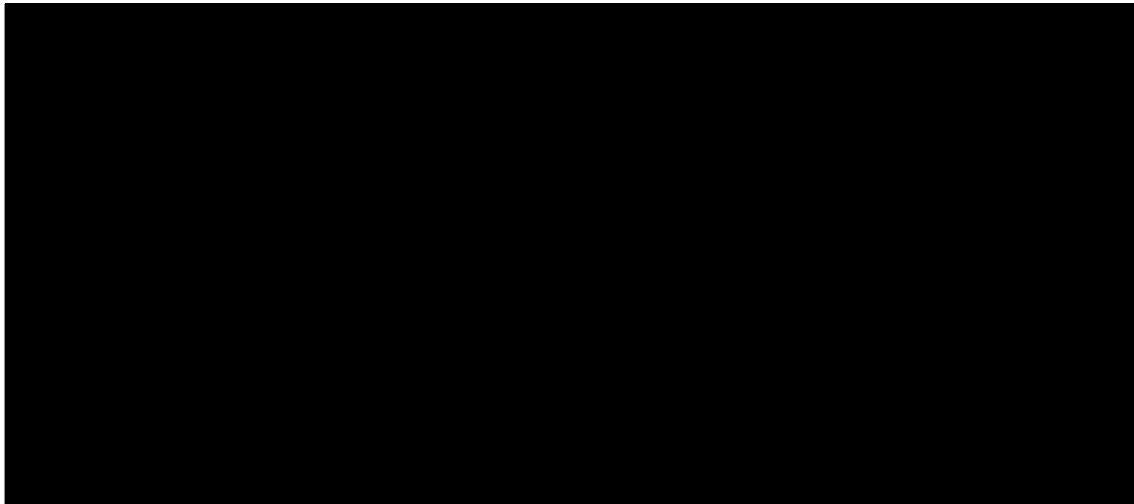GOOG-DOJ-AT-02433388

DV3's Today's Early Ad Selection System

Ad Repository

Project Brasília Overview

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Unified ranking mechanism across all eligible candidates

serving

DTX-1110 Page 4 of 28

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Running a single auction across the stack

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DTX-1110 Page 5 of 28

Scoring of ad candidates

DTX-1110 Page 6 of 28

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Brasília HDMI: A single bidding model across the stack

DTX-1110 Page 7 of 28

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Experiment Results

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Experiment Results: Overview

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	Impressions	Revenue
Total		
DBM		
GDA		
UAC		

RASTA

Reference: https://experiments.corp.google.com/#/portal/experiments/analysis?label=_:baEHaXUe-1bNdouFtJjUXRar-W0
June 17 ~ June 20

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Experiment Results: DV3 Spend on Sellside Slices

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	Impressions	DV3 Spend on Platform
AdSense		
ADX		
AdMob		
External Exchange		

RASTA

Rasta Reference:
https://experiments.corp.google.com/#/portal/experiments/analysis?label=_:uJkA7PW6nCeybh7CClwLpmf5CYY

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Experiment Results: DV3 Performance Metrics

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	Share of DV3 spend	Desired Spend (advertiser value)	Spend	REMH CPD
Fixed Bidding				
Max Conv				
Max Clicks				
Max ActiveView				

*Click-PD is used for Fixed Bidding.

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Resource Requirements

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DTX-1110 Page 12 of 28

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Appendix

DTX-1110 Page 13 of 28

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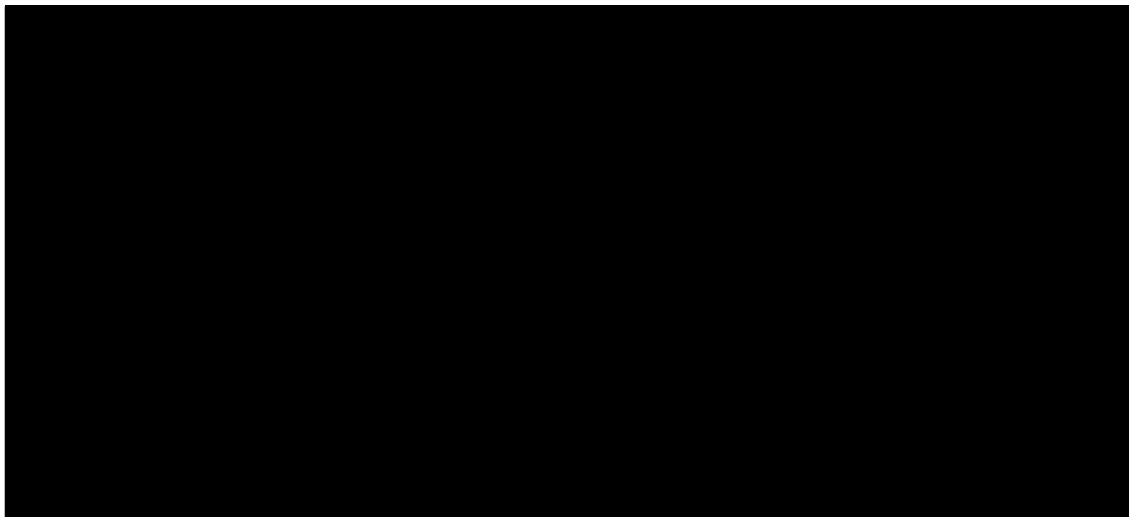
Experiment Results: Sellside View

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	Impressions	Revenue (all buyers)
AdSense		
ADX		
AdMob		
External Exchange		

RASTA

Rasta Reference:
https://experiments.corp.google.com/#/portal/experiments/analysis?label=_:2yAoLKSIACvR2p0mWAP7RfnkVqw

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Resource Breakdown

GOOG-DOJ-AT-02433401
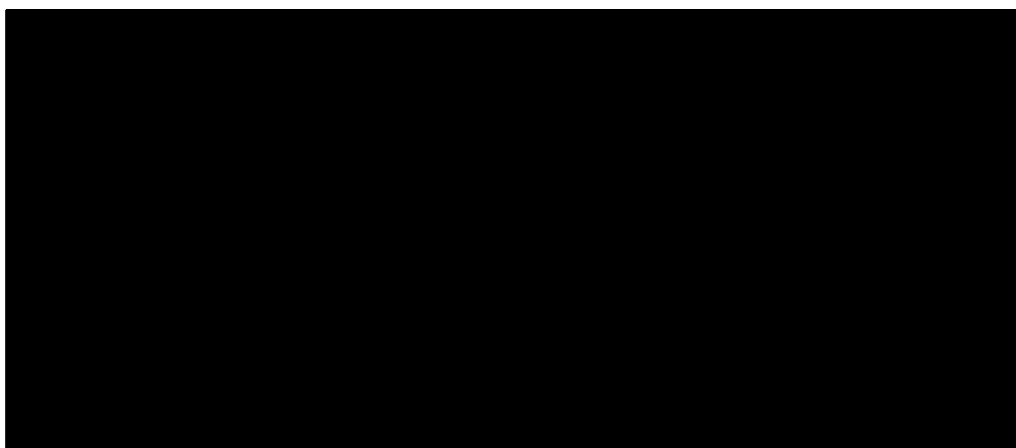
Current early ad selection system

To final scoring

- Designed to narrow down selection in many stages to reduce computational cost
  - Some filtering stages are expensive and need to be managed
- Includes many heuristics and hand-tuned logic & parameters (e.g., cutoffs)
- Scoring happens in *at least 4* different stages (highlighted), some are model-based and some are query-independent (e.g., heuristics)
  - Models have different prediction objectives (eCPM, clicks, conversions, users similarity, etc)
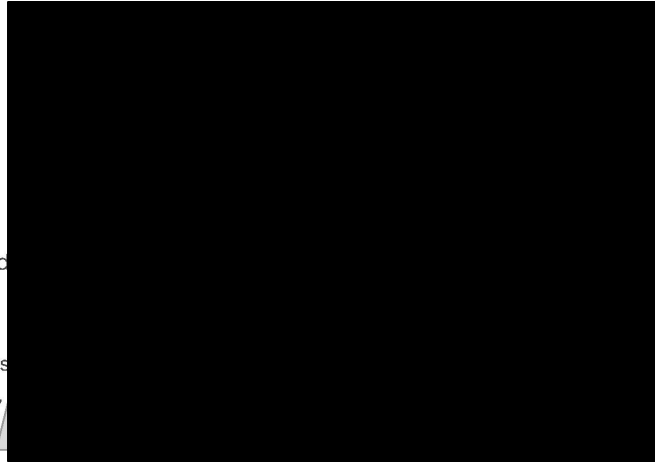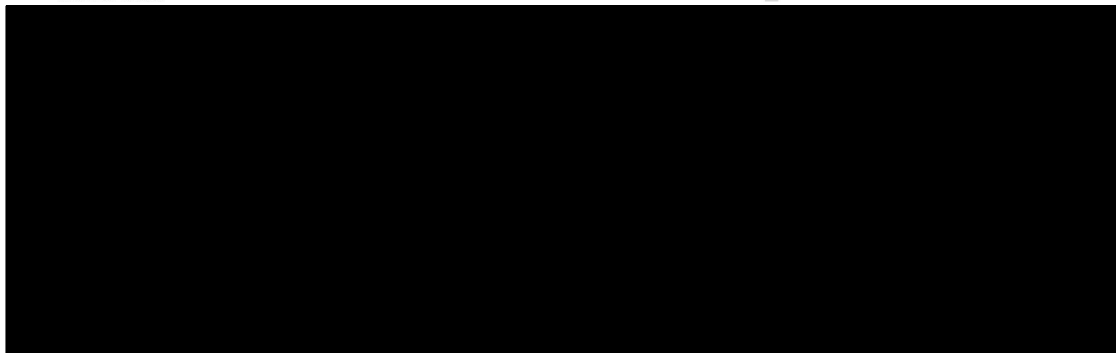
Google   See the full-list of AGS filters here.   Confidential + Proprietary

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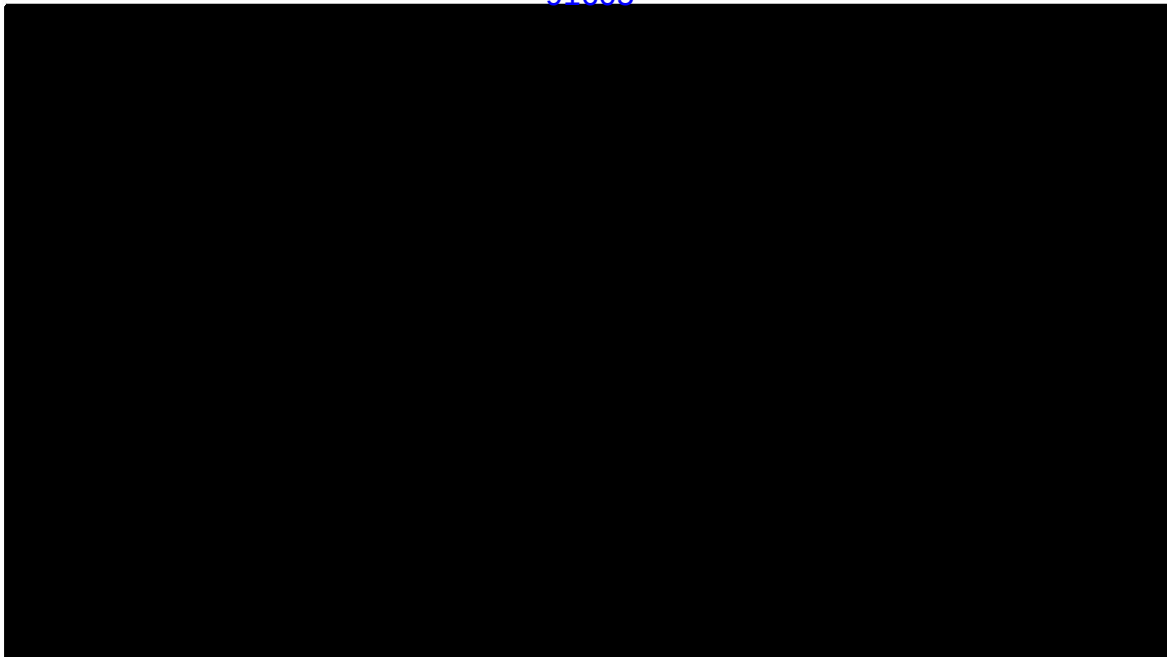
Brasilia early scoring design

Brasilia unified ranking has the following attributes:

To final scoring

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DTX-1110 Page 18 of 28

Intuition behind factorized models

[content query:
www.nytimes.com
user-interests: sports
Salient terms: NFL, Football]

Ad Candidates	Relevance Score
Nike sports accessories	0.85
Adidas running shoes	0.80
Gieco car insurance	0.60
Rolex luxury watches	0.55
Booking.com hotel ad	0.45
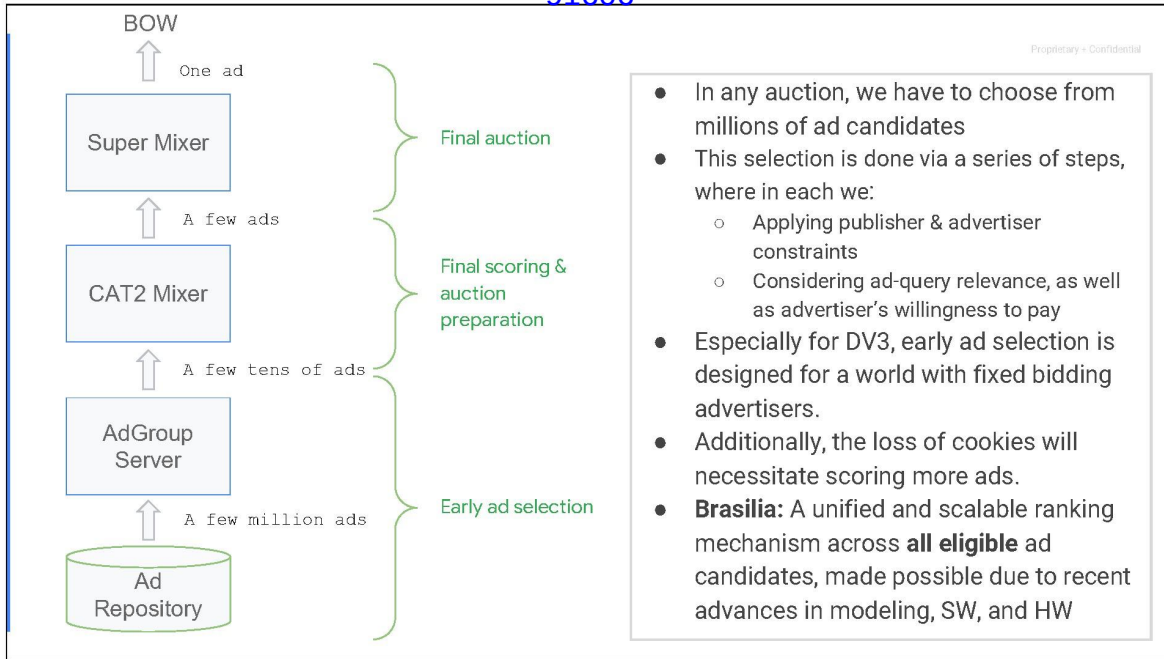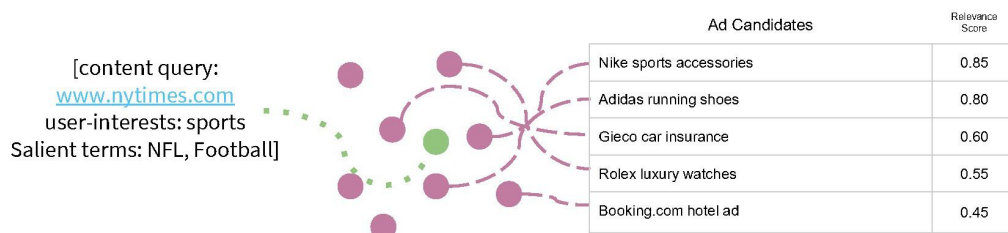
Project *queries* and *ad candidates* into a single **n-dimensional** space. *Ads* and *queries* are represented as unit vectors in that space such that "**relevant**" *ads* and *query vectors* have high cosine similarity. Ads that are "*irrelevant*" to a query have vectors that are almost perpendicular to the query vector.

"**Relevance**" can be defined by probability of user-interaction with the ad (such as a click or a conversion)

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Intuition behind factorized models

Content query where the domain is sports or user interests includes sports

Relevant ads can be retrieved by just searching the vicinity of the query vector, resulting in efficiency

Sports goods advertisers

Google

Ad embedding space

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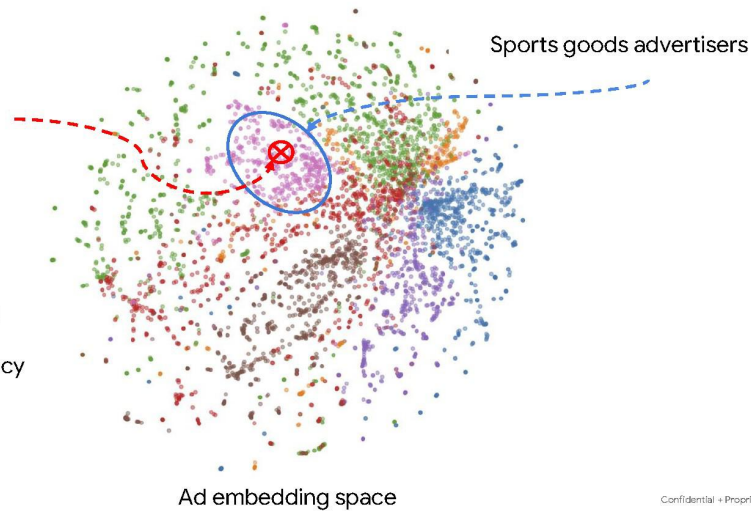
Desired Spend Example

Advertiser 1: Wants to buy conversions at $12CPA. targeting Bay Area

Advertiser 2: Wants to buy conversions at $10CPA. targeting California

Today (in any internal auction):

Say Auction discount is 50% in California, 20% in Bay Area. and assume CVR is 10% for both.

We calculate maxCPM1 = 12 * 10% / (80%) = **$1.5**, maxCPM2 = 10 * 10% / (50%) = **$2.0**.
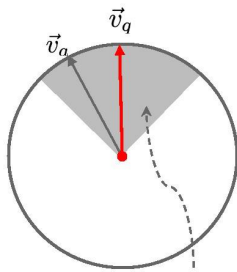
We allocate this auction to Advertiser 2.

But allocation to Advertiser 1 results in more revenue.

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Modeling Intuition

In 2-Dimensional space, query and ad vectors are projected into a unit circle.

$\vec{v}_q$
$\vec{v}_a$

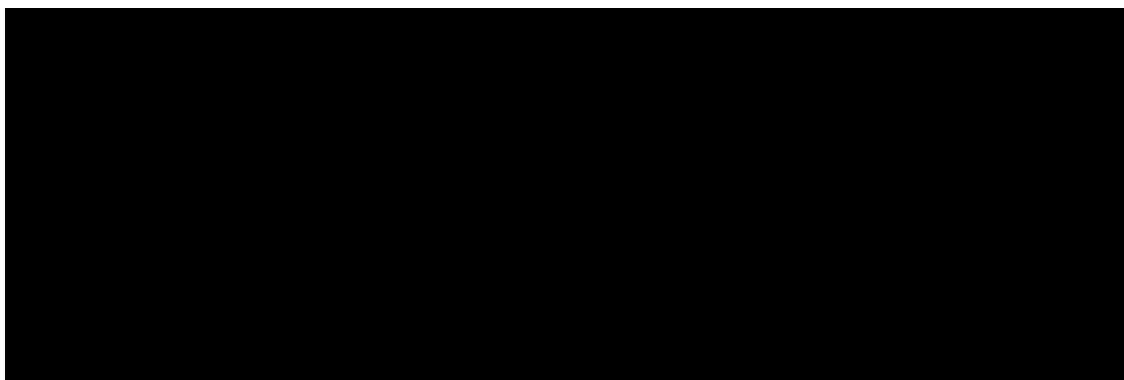Probability of
Cosine similarity score > 0.7
in 2-D is **0.25**

In 128-Dimensional space, query and ad vectors are projected into a unit sphere.

Probability of
Cosine similarity score > 0.7
in 128-D is **2.7e-20**!

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Serving Technology

DTX-1110 Page 24 of 28

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Brasília & LPA

- In today's world, **RMKT** and **AUDIENCE** targeting significantly reduce number of ad candidates that need to be scored by helping advertisers narrow down their audience
- In a world, where our ability to effectively use those tools to narrow down advertisers' audience is limited, we need a more effective, consistent, and scalable way to score and select ads using the optimization technology
- We plan to run an experiment (1%) to test **Brasília's** effectiveness in this world:
  - For non-remarketing ads, in the experiment arm, expand targeting to Run-of-Network (RON) and use Brasília scoring to select most relevant ads

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DTX-1110 Page 26 of 28

GOOG-DOJ-AT-02433413
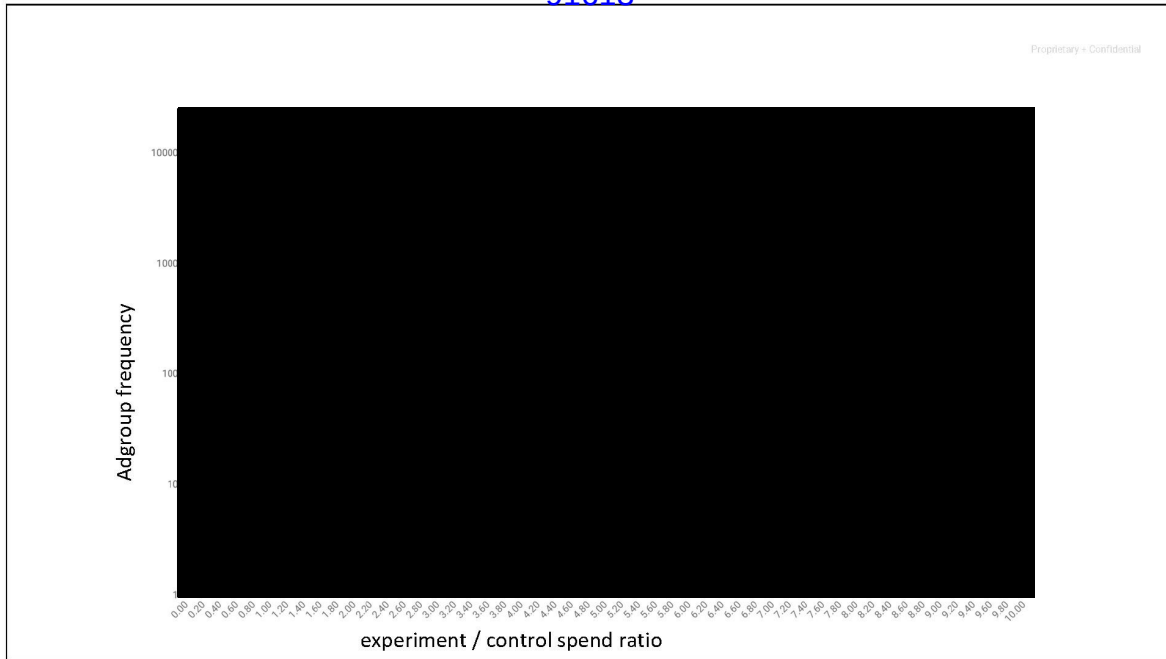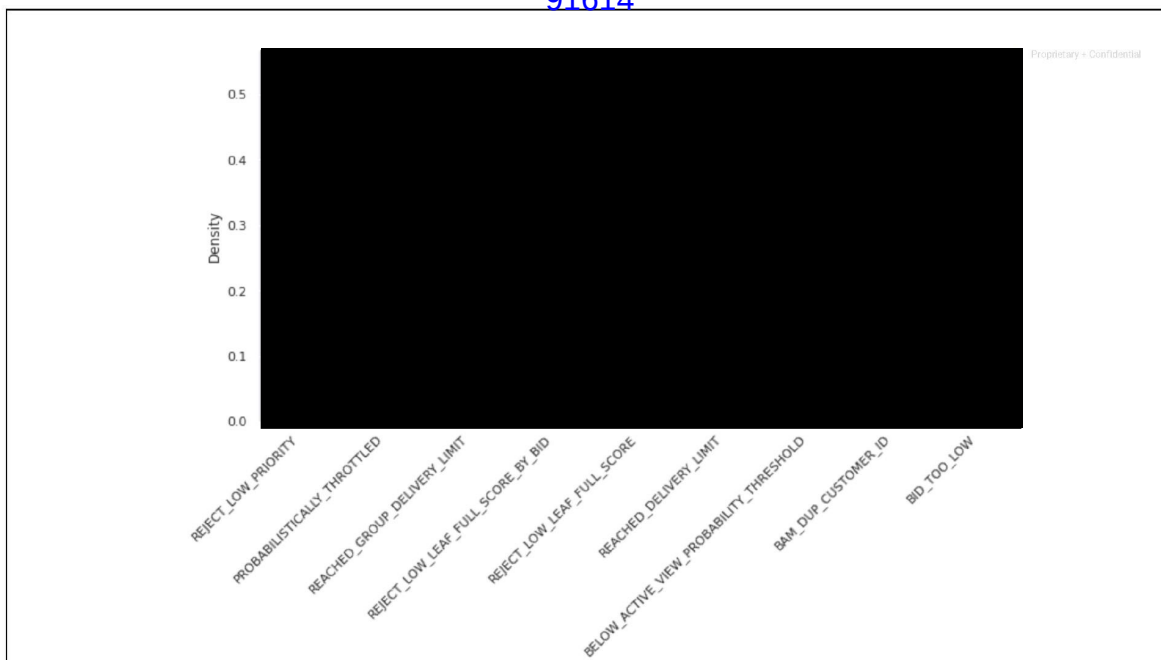
Factorized Prediction Model Quality

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Compared to Mixer pCTR	Overall	Adsense	Admob	Adx	3PE
AucLoss Reduction					

Compared to Mixer pCVR	Overall	Adsense	Admob	Adx	3PE
AucLoss Reduction					

Factorized pcvr with respect to publisher platforms: https://sa-metrics.corp.google.com/visualization?uuid=60d897b8-0000-2974-82f1-f4f5e808f7ac#w=byImpressions&cols=All&vert=false&metrics=1000
Factorized pcvr overall: https://sa-metrics.corp.google.com/visualization?uuid=60d48c07-0000-2341-929d-001a114c507a#w=byImpressions&cols=All&vert=false&metrics=1000

Factorized pctr overall: https://sa-metrics.corp.google.com/visualization?uuid=60d48bb8-0000-2341-929d-001a114c507a#w=byImpressions&cols=All&vert=false&metrics=1000

Factorized pctr with respect to publisher platform: https://sa-metrics.corp.google.com/visualization?uuid=60d897ca-0000-2974-82f1-f4f5e808f7ac#w=byImpressions&cols=All&vert=false&metrics=1000

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